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(we may call it *lingua*, not to be confounded with the ligule already mentioned). The tip of this lingua is deflected downwards, and from its base run backwards two long barbed processes. Over the mouth is a similar but simpler structure, called epipharynx, and to these the borders of the pharynx are attached, and also muscles. If we force open the mouth (by pulling down the maxillæ), we find the open mouth overarched by epipharynx (connected with the labrum), floored inwardly by the lingua (or inner tongue, formed by the floor of the pharynx), enclosed at the sides by the long tendons of the lingua which are stretched up like faucial door posts. All these hard parts keep open the soft membrane of the pharynx, just as the iron frame of a dredge keeps open the netting attached to it. In the upper part of the cranial cavity are racemose glands which send down a pair of ducts to the inner tongue. The great salivary apparatus of the thorax sends forward its ducts which unite and penetrate through the basi and medi-labium to the ligule or long outer-tongue.[1]

It would be premature, at the present stage of our knowledge, to theorize upon these facts. They indicate a fundamental unity of structure of the heads of all insects; but how far and in what directions it is varied, and what is its relation to other parts of the body, are questions needing further research.

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MYA ARENARIA IN SAN FRANCISCO BAY.

BY ROBERT E. C. STEARNS.

IN November, 1874, Dr. W. Newcomb, who at that time resided in California, described in the Proceedings of the California Academy of Sciences, a species of Mya which had been given to him by the well-known collector, Henry Hemphill, who detected several specimens of the form on the shore of Alameda county, on the eastern side of San Francisco bay.

The specimens were about two-thirds of the usual average size of *Mya arenaria*,[1] rather fragile in substance and delicate in sculpture.

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[1] Siebold discovered a triple salivary system in the bee; but the text books are still sadly at variance with each other and with the facts, in their treatment of this part of the subject. Some place the bee's salivary glands in the head, some in the thorax, and some say they are sometimes in one part and sometimes in the other!

As Dr. Newcomb considered it a new species, he described it as above and gave it the name of *M. hemphillii*, remarking that "the only species with which it can be confounded is the *Mya præcisa* of Gould, which Dr. Carpenter considers as identical with *M. truncata* of the North Atlantic. A specimen of *M. arenaria*, from Puget sound, in my collection, is quite distinct from this species, and, like many of the circumpolar species, is common to the North Pacific and North Atlantic. It is quite distinct from the fossil *M. montereyi* Conrad, as I am informed by Dr. Cooper, who kindly made for me the comparison of this shell with Conrad's figure and description."

Since 1874, the date of the description, the Mya has become abundant, and is found for miles alongside the easterly shore of the bay, and is now the leading clam in the markets of San Francisco and Oakland, superseding to a great extent the previous "clams," *Macerna nasuta* and *Tapes* (or more properly *Cuneus) staminea* Conrad, in its varieties, especially *diversa* Sby., and the now dominant clam of the fish-stalls, is found exhibiting all of the characteristics of *Mya arenaria*, and is universally conceded to be the same as the Atlantic species.

My friend, Dr. Newcomb, as quoted above, it will be seen, regarded his Puget sound Mya as *M. arenaria;* which is the region from which Gould's form, *Mya præcisa*, was brought, and if related to another form, is more likely to be a variety of the circumpolar *truncata* than to be *arenaria.*

None of the more recent and reliable collectors referred to in Carpenter's Supplementary Report (1863) to the British Association, neither any collector since this date, to my knowledge, has verified the occurrence of *M. arenaria* at any point north of San Francisco bay on the west coast of America. Gould was certainly familiar with a form so common on the New England coast; and though perhaps in this day and generation we hold rather broader views as to what constitutes a species than some of the old masters, yet he certainly would have noticed it, had the shells before him been closely like the more common Linnean species.

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[1] The only bivalve along the coast or in the bay of San Francisco which might be mistaken for or identified with *Mya arenaria* is *Schizothærus nuttalli* Conrad, which when mature is two or three times as large as the largest specimens of Mya. Dwarfed forms of the large species are found at low tide on the flats connected with Goat island on the east. In this species the siphons are enclosed in an external sheath, the same as in Mya, making what the unsophisticated call a "long neck."

Middendorff credits it to Sitka,[1] etc., but this is not supported by any of the numerous subsequent authorities.

As to its presence on the Asiatic side of the North Pacific, Middendorff credits it to "Kamchatka" and the "Ochotsk sea." Jay, in (Vol. II) Perry's Japan Expedition, describes it even as "*M. japonica*," and credits it to "Volcano bay, Island of Yeddo," remarking that it "is very similar to *M. arenaria*." Arthur Adams,[2] who collected in Japan, pronounced it identical. It has also been detected in Hakodadi bay, and Professor Morse says "the typical northern form *(M. arenaria)* lives in the Gulf of Yeddo to-day, and its shells are found in the mounds of Omori."[3]

It must be admitted that the species is found in these Asiatic stations upon the testimony here adduced, but as to its presence on the coast of Western America at any point north of or anywhere outside of San Francisco bay, the fact that neither Nuttall, Jewett, Kennerly, Lord, Swan, Cooper, Harford, Dunn, Hemphill, Hepburn, Fischer, Dall, Newcomb (in the field), and many others, as well as myself, have never detected a specimen prior to the date of my friend Newcomb's description (or since, so far as I can learn), ought to be sufficient evidence on this point.

From whence, then, came the seed which has produced the abundance of this species which has spread and is now spreading rapidly along the shores of San Francisco bay?

Examine the ancient shell heaps and mounds found hereabout, and one may find the thin broken valves of the Macomas, but not a fragment of the shell of Mya. One may find the shells of the native Haliotis and Olivella and the beads and money or ornaments made from them; the bones of the common California deer, of the whales, and perhaps other animals, all of which are still to be found in the neighborhood or not many miles away, but not a piece of Mya. The ancient clam-diggers, whose kitchen-middens are met with in many places on the Alameda and other shores of the bay, whose skeletons and implements are sometimes exhumed or discovered, had "passed over to the majority" centuries before the advent of *Mya arenaria* in California waters. To proceed to the question—was the seed of this mollusk introduced from the waters of the Asiatic shores of the North Pacific or from the American shores of the North Atlantic? If artificially introduced, of which there can be no doubt—from which direction does the extent and character of the traffic of our commercial intercourse make it most probable that the species came or was brought? By water on the steamships from Japan, or by railroad three thousand miles overland from the Atlantic seaboard?

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[1] B. A. Report, 1856, p. 219.

[2] Id. Rep., 1863, p. 588.

[3] AMER. NATURALIST, Sept., 1880, p. 657-8.

With the completion and operation of the trans-continental railroad, our oyster men, many of whom have a large capital invested in the business, commenced the importation of small oysters *(O. virginica)* from the Atlantic side, by the car load, for planting in San Francisco bay, where in a season or so they attain a merchantable size, growing exceedingly fat; as yet, efforts to propagate them have not been successful; but the importation still continues as before, the profit to the oyster planter being simply through increase in size and not from multiplication of numbers by propagation.

There is no similar traffic with Japan, and it is hardly possible that the fry of *Mya arenaria*, if it did adhere to the bottom of the steamers in Japanese parts would be able to hold on for so long a time or for so great a distance with the friction of the water against the bottom of the steamer constantly operating to sweep it off.

Native oysters are also imported from various points in Washington Territory, and planted in the bay, but we have no knowledge of the Mya existing at any point in the region from whence these latter oysters are brought.

In the presence of the fact of the rapid increase of this truly excellent edible, next to the oyster the most valuable either as human food or fish bait, of any of this class of food, and the inference from its spreading so readily in San Francisco bay, that other places along the coast might prove equally congenial to it, it would be a wise, public spirited act if the captains of our coasting vessels would take the trouble and incur the slight expense attending the planting of this clam at such points as their vessels touch at in the ordinary course of business.

Since the manuscript of the foregoing matter was sent to the NATURALIST, I have received specimens of *Mya arenaria* from my friend, Dr. C. L. Anderson, of Santa Cruz, for identification. Santa Cruz is on the coast at the northerly end of Monterey bay, about seventy-two miles south of the entrance to San Francisco bay. The specimens are rather under, than of, the usual size, and were obtained at the mouth of a lagoon near Santa Cruz.

In a few years we may look for its distribution southerly and along and around Monterey bay, the shores of which are well adapted for this species. As to its introduction at Santa Cruz, I hope to be able to give more particular information hereafter.

THE SQUID OF THE NEWFOUNDLAND BANKS IN ITS RELATION TO THE AMERICAN GRAND BANK COD FISHERIES.

BY H. L. OSBORN.

THE broad continental plateau which fringes our eastern coast, rises in many places near to the ocean's surface, and forms shallows known in sailor language as "banks." These banks have, on the average, a depth of thirty fathoms, though in some places but seven or eight fathoms, and are a favorite resort of the several species of our most important food fishes, visiting the places to prey upon the many forms of marine invertebrates covering these favoring spots in most luxuriant profusion. In most cases the banks are not extensive, not more than from ten to twenty miles in length, but this rule finds a notable exception in the case of the Grand Bank, off Newfoundland. This shoal is in shape nearly an equilateral triangle; its base is two hundred and seventy miles long, running east, north-east, and lying somewhat east of south-east from the island. This northern edge, furthermore, is sixty miles distant from land, and the intervening water has an average depth of eighty-five fathoms. The edge of this shoal is very clearly defined, the water along the northern limit falling suddenly, in the distance of only a mile or two, from thirty to sixty fathoms, while, on the other sides, the descent is frequently very rapid from thirty to one hundred and eighty fathoms. It has been noted as the most favorable grounds for the capture of the cod since before 1740, at which time seventy vessels from Gloucester alone, scoured the banks, and since which time the number has fluctuated, till at present more than four hundred schooners are engaged in the pursuit. The problem of bait has always been a troubling one to this enormous